



## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference MBO 5 PCT	<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/FI2004/000581	International filing date (day/month/year) 04.10.2004	Priority date (day/month/year) 03.10.2003	
International Patent Classification (IPC) or national classification and IPC D21C11/06			
Applicant OY METSÄ-BOTNIA AB et al.			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input type="checkbox"/> sent to the applicant and to the International Bureau a total of sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand  21.07.2005		Date of completion of this report  20.02.2006	
Name and mailing address of the International preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer  Naeslund, P  Telephone No. +49 89 2399-8614 	

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/FI2004/000581

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-12 as originally filed

**Claims, Numbers**

1-24 filed with telefax on 04.01.2006

**Drawings, Sheets**

1/5-5/5 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1-24
	No: Claims	NONE
Inventive step (IS)	Yes: Claims	1-24
	No: Claims	NONE
Industrial applicability (IA)	Yes: Claims	1-24
	No: Claims	NONE

2. Citations and explanations (Rule 70.7):

**see separate sheet**

**Re Item V**

*Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement.*

Reference is made to the following documents:

D1: US-A- 3525666

D2: US-A- 3650888

D3: CA-A-2 144 827 & SE-C-515972

1. None of the cited documents discloses or suggests a method for the desulphurisation of the circulation of chemicals in a sulphate pulp mill employing a Claus process comprising **two** combustion units as claimed in claim 1. The subject-matter of claim 1 which leads to an optimization of the desulphurization therefore is considered as both novel and inventive as required by Art. 33(2) and (3) PCT. A similar reasoning applies to use claim 19 as well as apparatus claim 20. The dependent claims refer to preferred embodiments and therefore are also novel and inventive.
2. For the assessment of the present claims on the question whether they are industrially applicable, no particular reasoning would appear necessary to give. The industrial application would appear to be evident (Art. 33(4) PCT).

**Re Item VII**

*Certain defects in the international application*

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents **D1** to **D3** is not mentioned in the description, nor are these documents identified therein. The description should be adapted upon entering regional/national phases where this is required.

DREX

**Claims**

1. A method for the desulphurization of the circulation of chemicals in a sulphate pulp mill, comprising
  - 5 - collecting concentrated odorous gases that contain sulphur compounds and
  - combusting them to oxidize the sulphur compounds,**characterized in that**
  - the concentrated odorous gases are combusted at an air index below one in a first combustion unit, using the Claus process so that at least an essential part of the sulphur
  - 10 compounds are oxidized into elemental sulphur, nonetheless so that at least 10 molar % of the sulphur compounds taken through the Claus system are taken to be combusted in the combustion device of the second combustion unit, and
  - the elemental sulphur is recovered in liquid or solid form.
- 15 2. A method according to claim 1, **characterized in that** the air index of the combustion is about 0.4 – 0.9.
3. A method according to claim 1 or 2, **characterized in that** the temperature of the combustion is about 1400 to 1800 °C.
- 20 4. A method according to claim 1, 2 or 3, **characterized in that** the desulphurization is integrated into the odorous gas exhaust system of the pulp mill.
5. A method according to any one of the preceding claims, **characterized in that** the sulphur is
- 25 condensed from the odorous gases after the combustion of the gases.
6. A method according to any one of the preceding claims, **characterized in that** the water of the boiler or cooling water circulation of the pulp mill is used to condense the sulphur.
- 30 7. A method according to any one of the preceding claims, **characterized in that** part of the collected odorous gases are conducted to Claus combustion and part of the sulphur compounds from the Claus combustion are conducted to conventional odorous gas combustion, or optionally part of the collected odorous gases are conducted directly to conventional odorous gas combustion.

8. A method according to any one of the preceding claims, characterized in that the at least part of the sulphur compounds of the concentrated odorous gases coming from the Claus combustion are conducted to conventional odorous gas combustion.
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9. A method according to any one of the preceding claims, characterized in that at least 10 molar % of the sulphur compounds from the Claus combustion are conducted to combustion in conventional combustion systems.
- 10
10. A method according to any one of the preceding claims, characterized in that part of the concentrated odorous gases are lead into a first combustion unit, which comprises one or more Claus system combustion devices (10; 20; 21; 40; 41) and part is lead into the second combustion unit comprising combustion in a soda recovery boiler (3; 53), odorous gas boiler (4; 54), lime sludge reburning kiln (5; 55) or flame (6; 56) or into more than one
- 15
- of these systems.
11. A method according to any one of the preceding claims, characterized in that at least 10 molar %, preferably 30 to 90 molar %, of the collected odorous gases are conducted into one or more Claus system combustion devices (10; 20; 21; 40; 41) for combustion.
- 20
12. A method according to any one of the preceding claims, characterized in that the collected odorous gases are combusted in the first combustion unit in the Claus system combustion device (10; 20; 21; 40; 41) and the residual tail gases are conducted to the second combustion unit to be combusted in the soda recovery boiler (3; 53), odorous gas
- 25
- boiler (4; 54), lime sludge reburning kiln (5; 55) or flame (6; 56) or in more than one of these systems.
13. A method according to any one of the preceding claims, characterized in that 50 to 90 molar %, typically 70 to 85 molar %, of the sulphur of the odorous gases lead into the
- 30
- Claus process are combusted to elemental sulphur.
14. A method according to any one of the preceding claims, characterized in that air, oxygen or a mixture thereof is used in the combustion of odorous gases.

15. A method according to any one of the preceding claims, characterized in that the elemental sulphur obtained from the Claus process is further combusted to sulphur dioxide or processed to form sulphuric acid.
- 5 16. A method according to any one of the preceding claims, characterized in that at least part of the elemental sulphur is fed back into the process, for example, by adding sulphur to white liquor or feeding the sulphur into the soda recovery boiler.
- 10 17. A method according to any one of the preceding claims, characterized in that the odorous gases are collected from the source of concentrated odorous gases of a cooking department or an evaporator plant (1; 2) separately or in combination.
- 15 18. A method according to any one of the preceding claims, characterized in that the amount of concentrated odorous gases is increased by means of a suitable method, such as thermal treatment of black liquor.
- 20 19. The use of the Claus process for the desulphurization of the circulation of chemicals in a sulphate pulp mill, so that the concentrated odorous gases are combusted with substoichiometric amounts of air into elemental sulphur in one or more combustion units of the Claus system and at least 10 molar % of the sulphur compounds taken through the Claus system are taken to be combusted in the combustion device of the at least one second combustion unit.
- 25 20. An arrangement for the desulphurization of the circulation of chemicals in a sulphate pulp mill, comprising:  
at least one odorous gas combustion unit (10; 20; 21; 40; 41), in which the flow of concentrated odorous gases can be collected and into which it can be conducted from a source of concentrated odorous gases (1, 2) and wherein the reduced sulphur contained in the concentrated odorous gases can be combusted,
- 30 characterized in that  
the combustion unit comprises a first combustion unit (10; 20; 21; 40; 41), which has at least one Claus system combustion device (10; 20; 21; 40; 41), which is provided with a feed inlet (14; 26; 29; 46; 49), which is connected to the source of concentrated odorous gases (1, 2), and with an exhaust outlet (15; 27; 32; 47; 57), through which the oxidized

and condensed sulphur compounds of the concentrated odorous gases can be removed from the device as elemental sulphur in a liquid or solid form, and a second combustion unit, whereby the first unit has an exhaust nozzle (16; 30; 50) for gaseous, uncondensed sulphur compounds, which is connected to the second combustion unit.

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21. An arrangement according to claim 20, characterized in that the combustion unit comprises at least two Claus system combustion devices (20; 21; 40; 41) connected in series, whereby the first combustion device comprises a combustion assembly (28; 48) for gaseous, uncondensed sulphur compounds, which is connected to the feed nozzles (29; 49) of the second combustion device.

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22. An arrangement according to any one of claims 20 to 21, characterized in that the first combustion unit comprises a Claus system combustion device (10; 20; 21; 40; 41) and a condenser (11; 22; 23; 42; 43) therein.

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23. An arrangement according to any one of claims 20 to 22, characterized in that the second combustion unit comprises a odorous gas boiler (53), soda recovery boiler (54), lime sludge reburning kiln (55) and/or flame (56).

20 24. An arrangement according to any one of claims 20 to 23, characterized in that the feed nozzle (14; 26; 46) of the first combustion unit is connected to a distribution piece (17; 31; 51) so that part of the concentrated odorous gases can be lead through the distribution piece and past the first combustion unit into the second combustion unit.

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